

6060B/6061A

**SYNTHESIZED RF
SIGNAL GENERATOR**

IEEE-488
Quick Reference

Giga-tronics

NOTE

IEEE-488 reference information for both the 6060B and the 6061A are provided here. Wherever "6060B" is mentioned, remember that the related descriptions also pertain to the 6061A.

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IEEE-488 ADDRESS

The IEEE-488 Address is determined by the positions of the IEEE-488 INTERFACE switches a1 through a5. The switches represent a right hand justified binary code for 0 through 31. Valid Address codes are 0-30. Do not use Address 31 since this is a special code.

Press the SPCL pushswitch then the DATA 1,0 push switches to display the IEEE-488 Address. The Address will appear in the FREQUENCY Display as a number with the base ten.

The 6060B operates in the LISTEN ONLY or TALK ONLY mode if the LISTEN ONLY (switch 7) or the TALK ONLY (switch 6) is in the "1" position (ON) when power is turned on. The unit will be in teh TALK ONLY mode if both switches are on.

IEEE-488 INTERFACE FUNCTIONS SUPPORTED

FUNCTION DESCRIPTION

| | |
|-----|---|
| SH1 | Complete source handshake capability. |
| AH1 | Complete acceptor handshake capability. |
| T5 | Basic Talker, Serial Poll, Talk Only, Unaddressed if MLA. |
| L3 | Basic Listener, Listen Only, Unaddressed if MTA. |
| SR1 | Complete service request capability. |
| RL1 | Complete Remote/Local capability. |
| PPO | No Parallel Poll capability. |
| DC1 | Complete Device Clear capability. |
| DT1 | Complete device trigger. |
| CO | No controller functions. |
| E1 | Open collector drivers. |

DEVICE DEPENDENT PROTOCOL

There are four general forms of 6060B device dependent messages:

1. <HEADER>
2. <HEADER> <DATA>
3. <HEADER> <DATA> <SUFFIX>
4. <HEADER> <SUFFIX>

Where:

1. HEADER is one or two ASCII characters that define the type of message.
2. DATA is one of five possible entries that modify the header or that provide related information:
 - a. Boolean Data: 0 or 1 indicate the OFF or ON state, respectively.
 - b. Unsigned integer (it is understood that, for the 6060B the number is hexadecimal if the left hand character is an X).
 - c. Floating Point Data: It is understood that, for the 6060B the power-of-ten to which the stated number is raised follows the designator E unless the power-of-ten is a plus one. Neither the designator E nor the power-of-ten is stated if the power-of-ten is a plus one. For example, 123E-6 is 0.000123 and 123E3 is 123.000, but 123 is 123.
 - d. Special Function: The 6060B Special Functions may be used with the SP header without using a suffix.
 - e. String record: This numeric is used with the CT (Configure Trigger) message only.

DEVICE DEPENDENT PROTOCOL (cont)

3. SUFFIX is one of six possible entries that modify the header or the data or that provide additional information:
 - a. Amplitude Units: V=volts
MV=millivolts
UV=microvolts
NV=nanovolts
DB=dB or dBm
 - b. Frequency Units: GZ=gigahertz
MZ=megahertz
KZ=kilohertz
HZ=hertz
 - c. Bit designators: Alpha characters that refers to hardware bits used with IB or OB header.
 - d. AM Depth Units: PC = %
 - e. LI or LM strings which are coded numeric representations of the front panel setup.
 - f. DAC suffix designator: This suffix is used only with the OD (Output DAC bits) message.

The instrument recognizes both upper and lower case characters, but treats all characters as if they were upper case. For example, the instrument interprets mv, mV, or MV all as being MV.

The instrument ignores spaces and tabs.

The instrument recognizes two types of command terminators: string terminators (, or ;) and record terminators (CR, LF, or EOI). String terminators are ignored during normal operation, but are used for synchronization purposes during syntax error recovery. During syntax error recovery, everything is discarded starting with the wrong command and ending with the next end of string (EOS) or the next end of record (EOR) terminator. End of record terminators cause command records to be processed when the instrument is in the Record IEEE-488 Interface Mode. CR and LF are mutually exclusive; either one or the other can be designated as the EOR character. The instrument ignores the character not designated as the EOR character.

FUNCTION

Amplitude Entry
Binary Learn Commands
Clear Commands
Edit Entry
Frequency Entry
Interface Mode Commands
Interrogate Commands
Memory Entry
Modulation Entry
Monitor Commands

RF ON/OFF Entry
Special Function Entry
SRQ Commands
Step Entry

Trigger Commands

COMMAND HEADERS

AP, SP3x, RA, SP8x, SP9x
LI, LM
CB, CE, CL
AB, DB, FB, PB, KB, KA, KD, KF, KP
FR, SP2x, RF
EM, RM, TM, VM, UM, @
IA, ID, IE, II, IL, IO, IR, IT, IU, IV
RC, ST, SQ
AM, AE, AI, FM, FE, FI, MR, MF
IBM, OB, OD, RB, RW, DW, WB, WW, XA,
XB, XD, XR
RO
SP
IM, SM, XF
FS, LS, PS, DS, SU, SD, FU, FD, LU, LD,
PU, PD, DU, DD
CT, TR

IEEE-488 COMMANDS

| COMMAND USE | COMMAND | | | COMMENTS |
|------------------------------|---------|----------------|---------------------------|--|
| | HEADER | NUMERIC | SUFFIX | |
| AMPLITUDE ENTRY | | | | |
| Program Amplitude | AP | float | V MV UV NV DB | Program displayed amplitude in units of: volts millivolts microvolts nanovolts dB or dBm |
| Convert Amplitude Units | AP | none | V MV UV NV DB | Change amplitude units to: volts volts volts volts dB or dBm |
| Relative Amplitude | SP | 30/31 | none | Disable/enable relative amplitude operation |
| Relative Amplitude | RA | 0/1 | | Alternate programming command for disable/enable relative amplitude operation. |
| Level Correction | SP | 80 81 82 | none | Enable all level correction. Disable all level correction. Disable attenuator correction. |
| Amplitude Fixed Range | SP | 90/91 | none | Disable/enable amplitude fixed-range operation. |
| BINARY LEARN COMMANDS | | | | |
| Store a Front Panel Setup | LI | int | string | The Generator stores the string into the memory location specified by int. See the Command Description paragraph* for decoding the learn string. |
| Send a Front Panel Setup | LM | int | none | The Generator responds with the contents of the memory location specified by int. See the Command Descriptions paragraph* for decoding the learn string. |
| FREQUENCY ENTRY | | | | |
| Frequency Programming | FR | float | GZ MZ KZ HZ | Program displayed frequency in units of: gigahertz megahertz kilohertz hertz |
| Relative Frequency | SP | 20/21 | none | Disable/enable relative frequency operation. |
| Relative Frequency | RF | 0/1 | none | Alternate programming command for disable/enable relative frequency operation. |

*Refer to paragraph numbers in 6060B Manual.

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|--------------------------------|---------|---------|---------------------------|--|
| | HEADER | NUMERIC | SUFFIX | |
| INTERFACE MODE COMMANDS | | | | |
| Error Mode | EM | 0/1 | none | Disable/enable the clear error mode. If disabled, the IEEE-488 error status is cleared only when interrogated. If enabled, the error status is cleared when a new message is processed. |
| Record Mode | RM | 0/1 | none | Disable/enable the record mode. If disabled, the message unit is a command. If enabled, a message unit is a record. The message unit is the smallest group of characters that the Generator processes. |
| Record Terminator Mode | TM | 0/1 | none | Selects the LF/CR character as the record terminator. The record terminator is used on input in the record mode and is sent following all output. |
| Output Valid Mode | VM | 0/1 | none | Disable/enable the output valid mode. In the output valid mode, the Generator waits to process commands until the RF output has become valid. |
| Unbuffered Mode | UM | 0/1 | none | Disable/enable the unbuffered mode. If disabled, all input is buffered. If enabled, only one message unit is buffered. |
| "@" Modes | @ | int | none | The "@" command may be used as an alternate method of programming interface modes. |
| STEP ENTRY | | | | |
| Program FREQ STEP Size | FS | float | GZ MZ KZ .HZ | Program frequency step size in units of: gigahertz megahertz kilohertz hertz |
| Program AMPL STEP Size | LS | float | V MV UV NV DB | Program amplitude step size in units of: volts millivolts microvolts nanovolts dB |

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|-------------------------------|---------|--|----------------------|---|
| | HEADER | NUMERIC | SUFFIX | |
| TRIGGER COMMANDS | | | | |
| Program AM STEP Size | PS | float | PC | Program AM step size in percent. |
| Program FM STEP Size | DS | float | GZ MZ KZ HZ | Program FM step size in units of: gigahertz megahertz kilohertz hertz |
| Step Up/Down | SU/SD | none | none | Step the currently selected step function up/down one step. |
| Step Up/Down Frequency | FU/FD | none | none | Change the current step function to frequency and step frequency up/down one step. |
| Step Up/Down Amplitude | LU/LD | none | none | Change the current step function to amplitude and step amplitude up/down one step. |
| Step Up/Down AM | PU/PD | none | none | Change the current step function to AM and step AM up/down one step. |
| Step Up/Down FM | DU/DD | none | none | Change the current step function to FM and step FM up/down one step. |
| RF ON/OFF ENTRY | | | | |
| RF Output | RO | 0/1 | none | Turn RF output off/on. |
| SPECIAL FUNCTION ENTRY | | | | |
| Special Functions | SP | 00 02 03 04 07/08 09 10 11 12/13 14 15 16 20/21 30/31 70 71 72 80 81 82 83-86 90/91 | | Clears all special functions Initiates self test Display check Key check Set/reset SRQ Display S/W rev and instr ID Display IEEE-488 address Display self-test results Turn on/off display Initialize memory Latch test Display option loading Disable/enable relative freq Disable/enable relative ampl Medium key repeat rate Fast key repeat rate Slow key repeat rate Enable all level correction Disable all level correction Disable attenuator correction Program alternate 24dB attens Disable/enable ampl fixed range |

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|---------------------------------|---------|---------|---------------------------|---|
| | HEADER | NUMERIC | SUFFIX | |
| SRQ COMMANDS | | | | |
| Interrogate SRQ Mask | IM | none | none | Interrogate the SRQ mask. The Generator responds with the decimal value of the SRQ mask. |
| Set SRQ | SM | int | none | The SRQ mask is set to int. |
| Local Operation Alert Mode | XF | 0/1 | none | Disable/enable a mode to set SRQ each time a local entry is made. This SRQ is enabled by setting the front panel bit in the SRQ mask. |
| CLEAR COMMANDS | | | | |
| Clear IEEE-488 Output Buffer | CB | none | none | Clears IEEE-488 output buffer. |
| Clear error | CE | none | none | Clears the IEEE-488 rejected entry status. |
| Device Clear | CL | none | none | Clears the instrument state. |
| EDIT ENTRY | | | | |
| Position Amplitude Bright Digit | AB | float | V MV UV NV DB | Position the bright digit in the AMPLITUDE display with the stated resolution. For example, enter "AB10MV" for a 10mV resolution. |
| Position FM Bright Digit | DB | float | GZ MZ KZ HZ | Position the bright digit in the FM display with the stated resolution. For example, enter "DB1KZ" for a 1kHz resolution. |
| Position Frequency Bright Digit | FB | float | GZ MZ KZ HZ | Position the bright digit in the FREQUENCY display with the stated resolution. For example, enter "FB1MZ" for a 1MHz resolution. |
| Position AM Bright Digit | PB | float | PC | Position the bright digit in the AM display with the stated resolution. For example, enter "PB1PC" for a 1% resolution. |
| Edit | KB | float | none | Edit the current bright digit by float counts. |
| Edit Amplitude | KA | float | none | Move the bright digit to the AMPLITUDE display and edit amplitude by float counts. |
| Edit FM | KD | float | none | Move the bright digit to the FM display and edit FM by float counts. |

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|-----------------------------|---------|---------|--------|--|
| | HEADER | NUMERIC | SUFFIX | |
| EDIT ENTRY (cont) | | | | |
| Edit Frequency | KF | float | none | Move the bright digit to the FREQUENCY display and edit frequency by float counts. |
| Edit AM | KP | float | none | Move the bright digit to the AM display and edit AM by float counts. |
| INTERROGATE COMMANDS | | | | |
| Attenuator Counts | IA | none | none | The Generator responds with seven counts. Each count indicates the total number of actuations for one of the seven attenuator sections in the Generator. |
| Instrument Identification | ID | none | none | The Generator responds with its model number, for example, "6060B." |
| Elapsed Time Indicator | IE | none | none | The Generator responds with the total operating time since the Generator was manufactured. |
| Interface Modes | II | none | none | Interrogate the interface modes selected. The Generator responds with an unsigned integer. |
| Error Log | IL | none | none | The Generator responds with ten error log entries. Each entry is an uncal error code or a self test result and the elapsed time of when the error was logged. |
| Option Loading | IO | none | none | Interrogate the option loading. The Generator responds with the message: d1, d2, d3 d1 is the instrument code. d2 is the digital and synthesizer options. d3 is the output options. See the Interrogate Commands paragraphs* for details. |
| Rejected Entry | IR | none | none | Interrogates the rejected entry error codes. The Generator responds with three octal fields: "AAAAA,BBBBB,CCCCC." See Table 2-6 for a list of rejected entry error codes.* |

*Refer to table and paragraph numbers in 6060B Manual.

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|------------------------------------|---------|---------|----------------|--|
| | HEADER | NUMERIC | SUFFIX | |
| INTERROGATE COMMANDS (cont) | | | | |
| Self Test | IT | none | none | Interrogates the results of the self tests. The Generator responds with the self-test results. See paragraph 4D-20 for self-test codes.* |
| UNCAL | IU | none | none | Interrogates the uncalibrated output error codes. The Generator responds with three octal fields: "AAAAA,BBBBB,CCCCC." See Table 2-5 for a list of uncal error codes.* |
| Software Version | IV | none | none | Interrogate the software version. The Generator responds with the status message: "Vxx.x" where x's are decimal digits representing the current software revision level. |
| MONITOR COMMANDS | | | | |
| Input Bit | IB | none | BIT Designator | Respond with the value of the designated hardware bit. |
| Output Bit | OB | 0/1 | BIT Designator | Set the designated hardware bit to 0 or 1. |
| Output Dac | OD | int | DAC Designator | Set the value of the designated hardware DAC to the value specified by int. |
| Read Byte | RB | int | none | Read the value of the addressed byte. The Generator responds with an unsigned integer. |
| Read Word | RW | int | none | Read the value of the addressed word. The Generator responds with an unsigned integer. |
| Define Write Address | DW | int | none | Defines the address to be used by the write byte/word commands. |
| Write Byte | WB | int | none | Write int into the address specified with the define write address command. |
| Write Word | WW | int | none | Write int into the address specified with the define write address command. |

*Refer to table and paragraph numbers in 6060B Manual.

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|--------------------------------|---------|---------|----------------------|---|
| | HEADER | NUMERIC | SUFFIX | |
| MONITOR COMMANDS (cont) | | | | |
| Read Attenuation | XA | none | none | Read the current attenuation. The Generator responds with an unsigned integer. |
| Write Attenuation | XB | int | none | Change attenuation to 6dB times the unsigned integer. The integer can be 0 to 23. |
| Set Frequency Direct | XD | float | GZ MZ KZ HZ | Set the frequency hardware directly to the specified synthesizer frequency. |
| RF Output | XR | 0/1 | none | "XR0" programs all attenuation. "XR1" restores attenuation to its previous state. |
| MEMORY ENTRY | | | | |
| Recall | RC | int | none | Recall the front panel setup stored at the memory location specified by int. |
| Store | ST | int | none | Store the current front panel setup at the memory location specified by int. |
| Sequence | SQ | none | none | Sequence (recall) to the next higher memory location. |
| MODULATION ENTRY | | | | |
| Program AM | AM | float | PC | Program AM depth in percent. |
| External AM | AE | 0/1 | none | Disable/enable external AM modulation. |
| Internal AM | AI | 0/1 | none | Disable/enable internal AM modulation. |
| Program FM | FM | float | GZ MZ KZ HZ | Program FM deviation in units of: gigahertz megahertz kilohertz hertz |
| External FM | FE | 0/1 | none | Disable/enable external FM modulation. |
| Internal FM | FI | 0/1 | none | Disable/enable internal FM modulation. |
| Program Mod Freq | MR | 0/1 | none | Program modulation frequency to 400 Hz/1000 Hz. |
| Program Mod Freq | MF | float | GZ MZ KZ HZ | Program modulation frequency in units of: gigahertz megahertz kilohertz hertz |

IEEE-488 COMMANDS (cont)

| COMMAND USE | COMMAND | | | COMMENTS |
|-------------------------|---------|---------|--------|---|
| | HEADER | NUMERIC | SUFFIX | |
| TRIGGER COMMANDS | | | | |
| Configure Trigger | CT | string | none | Configures the trigger. Each time a trigger command or a group execute trigger interface message is received, the Generator executes the string of commands. The string record must end with a record terminator. |
| Trigger | TR | none | none | Trigger command. Equivalent to the group execute interface message. Upon processing the trigger command, the Generator executes the string, which has been preprogrammed with the configure trigger command. |

NOTES

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